

PATENT
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IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Nobushige ARAI, et al.

Int'l. Appl. No.: PCT/JP01/04471

Appl. No.: New Group: Unassigned

Filed: January 16, 2002 Examiner: Unassigned

For: WASTEWATER TREATMENT AGENT, POLLUTED
WATER PURIFIER, WASHING MACHINE WITH A
PURIFIER, AND POLLUTED WATER PURIFYING
METHOD

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

January 15, 2002

Sir:

The following preliminary amendments and remarks are respectfully submitted in connection with the above-identified application.

IN THE SPECIFICATION:

Please amend the specification as follows:

Before line 1, insert --This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/JP01/04471 which has an International filing date of May 28, 2001, which designated the United States of America.--

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Page 4, please delete the 3rd paragraph beginning on line 18 and replace with the following:

--To achieve the above objects, according to the present invention, a wastewater treatment agent flocculates a surfactant component present in wastewater with a primary flocculant composed of a high-molecular-weight inorganic flocculant or a mixture of a high-molecular-weight inorganic flocculant and a low-molecular-weight inorganic flocculant and makes the resulting flocks grow larger with a secondary flocculant composed of a high-molecular-weight organic flocculant.--

Page 5, please delete the 1st full paragraph beginning on line 6 and replace with the following new paragraph:

--According to the present invention, a polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant, or a washing machine incorporating such a purifier, is provided with: a polluted water tank for storing the polluted water, a first mixer for mixing the polluted water a primary flocculant to produce primary flocks; a second mixer for mixing the polluted water containing the primary flocks with a secondary flocculant and air to produce secondary flocks; an agitator for agitating the polluted water containing the flocculant

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and the air so as to make the secondary flocks grow larger; and a separator for separating the secondary flocks thus grown. Here, the polluted water tank, the first mixer, the second mixer, the agitator, separator are coupled in this order to form a circulation path that leads back to the polluted water tank.--

IN THE CLAIMS:

Please cancel claims 1-86 without prejudice or disclaimer of the subject matter contained therein and replace with the following new claims.

--87. A wastewater treatment agent that flocculates a surfactant component present in wastewater with a primary flocculant composed of a high-molecular-weight inorganic flocculant or a mixture of a high-molecular-weight inorganic flocculant and that makes resulting flocks grow larger with a secondary flocculant composed of a high-molecular-weight organic flocculant.

88. A wastewater treatment agent as claimed in claim 87, wherein the high-molecular-weight inorganic flocculant is polyaluminum chloride and the low-molecular-weight inorganic flocculant is aluminum chloride.

89. A wastewater treatment agent as claimed in claim 88, wherein the polyaluminum chloride and the aluminum chloride are mixed in a ratio of 4:1 to 6:1 by weight on an aluminum oxide basis.

90. A wastewater treatment agent as claimed in claim 87, wherein the high-molecular-weight organic flocculant is polyacrylamide.

91. A polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant, comprising:

a mixer for mixing the polluted water with the flocculant and air;

an agitator for agitating the polluted water, containing the flocculant and the air, that flows into a cylindrical agitation chamber along an inner surface thereof by making the polluted water into a spiraling stream so that flocks formed by the flocculant hold bubbles; and

a separator, connected to the agitator, for temporarily storing the polluted water and for separating the flocks holding the bubbles.

92. A polluted water purifier as claimed in claim 90, wherein the mixer has an aspirator for sucking in the flocculant and the air under a reduced pressure.

93. A polluted water purifier as claimed in claim 90, wherein the agitation chamber is arranged upright and has a cylindrical mixing cylinder provided inside, and the polluted water, containing the flocculant and the air, first flows up as the spiraling stream along the inner surface of the agitation chamber and then flows down inside the mixing cylinder.

94. A polluted water purifier as claimed in claim 93, wherein the mixing cylinder has a spiral fin composed of a plurality of serially coupled substantially rectangular plate-shaped members each having opposite sides thereof twisted at a predetermined angle.

95. A polluted water purifier as claimed in claim 93, wherein the separator is formed integrally with and fitted detachably to the agitation chamber.

96. A polluted water purifier as claimed in claim 90, wherein the separator has a reservoir section for temporarily storing the polluted water and discharging the polluted water from a topmost section thereof and a filter section for filtering out the flocks contained in the polluted water that has flowed out of the reservoir section.

97. A polluted water purifier as claimed in claim 96, wherein the reservoir section is arranged inside the filter section.

98. A polluted water purifier as claimed in claim 96, wherein the filter section collects the flocks with a collecting member composed of a washing net.

99. A polluted water purifier as claimed in claim 90, wherein a member arranged in a path of the polluted water has an inner wall thereof treated with non-cohesion treatment.

100. A polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant, comprising:

a polluted water tank for storing the polluted water;

a first mixer for mixing the polluted water with a primary flocculant to produce primary flocks,

a second mixer for mixing the polluted water containing the flocculant and the air so as to make the secondary flocks grow larger; and

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an agitator for agitating the polluted water containing the flocculant and the air so as to make the secondary flocks grow larger; and

a separator for separating the secondary flocks thus grown;

wherein the polluted water tank, the first mixer, the second mixer, the agitator, and the separator are coupled in this order to form a circulation path that leads back to the polluted water tank.

101. A polluted water purifier as claimed in claim 100,

wherein the first mixer has an aspirator for sucking in the flocculant, a first adder for adding the flocculant in a predetermined amount, and a first agitating chamber, cylindrical in shape, for agitating the polluted water containing the flocculant by making the polluted water into a spiraling stream.

102. A polluted water purifier as claimed in claim 101,

wherein the first adder controls the amount in which the flocculant is added according to concentration, turbidity, or a pH value of the polluted water.

103. A polluted water purifier as claimed in claim 100,

wherein the second mixer has an aspirator for sucking in the flocculant to mix the flocculant with the polluted water containing

the flocks, a second adder for adding the flocculant in a predetermined amount, and a sucker for sucking in the air.

104. A polluted water purifier as claimed in claim 103, wherein the second adder controls the amount in which the flocculant is added according to concentration, turbidity, or a pH value of the polluted water.

105. A polluted water purifier as claimed in claim 100, wherein the agitator is provided with a second agitation chamber cylindrical in shape and arranged upright and a mixing cylinder cylindrical in shape and arranged inside the second agitation chamber, and the polluted water, containing the flocculant and the air, first flows up as a spiraling stream along an inner surface of the second agitation chamber and then flows down inside the mixing cylinder.

106. A polluted water purifier as claimed in claim 105, wherein the mixing cylinder has a spiral fin composed of a plurality of serially coupled substantially rectangular plate-shaped members each having opposite sides thereof twisted at a predetermined angle.

107. A polluted water purifier as claimed in claim 106,
wherein the separator has a reservoir section for storing
the polluted water and a bag-shaped net, arranged inside the
reservoir section, for collecting the secondary flocks as the
secondary flocks float on the polluted water.

108. A polluted water purifier for collecting a pollutant
present in polluted water by flocculating the pollutant with a
flocculant, comprising:

an aspirator for sucking in the flocculant and air to mix
the flocculant and the air with the polluted water and thereby
produce flocks holding bubbles; and

a separator for separating the flocks holding the bubbles
from the polluted water.

109. A polluted water purifier as claimed in claim 108,
wherein the flocculant is a solution of polyaluminum
chloride or aluminum chloride in water.

110. A polluted water purifier as claimed in claim 108,
wherein the flocculant is a mixture of an inorganic
flocculant and a polymer flocculant or a solution of the mixture
in water.

111. A polluted water purifier as claimed in claim 109,
wherein an auxiliary aspirator for sucking in the
flocculant and mixing the flocculant with the polluted water is
provided on an upstream side of the aspirator, the auxiliary
aspirator being supplied with the inorganic flocculant, the
aspirator being supplied with an organic flocculant.

112. A polluted water purifier as claimed in claim 111,
wherein the aspirator is given a higher degree of vacuum
than the auxiliary aspirator.

113. A polluted water purifier as claimed in claim 108,
wherein a mixing bath for mixing the flocculant with the
polluted water is provided on an upstream side of the aspirator.

114. A polluted water purifier as claimed in claim 108,
wherein the flocculant is supplied to the aspirator after
being diluted according to concentration of the pollutant
contained in the polluted water.

115. A polluted water purifier as claimed in claim 108,

wherein the aspirator has a downstream-side portion thereof divided into a plurality of parts.

116. A polluted water purifier as claimed in claim 108, wherein the separator is a filtering device filled with a granular filtering material.

117. A polluted water purifier as claimed in claim 108, wherein the separator separates the flocks from the polluted water by letting the flocks holding the bubbles float on the polluted water.

118. A polluted water purifier as claimed in claim 108, wherein the separator has an inner layer portion formed substantially in a shape of a truncated cone whose diameter decreases from bottom to top, an inlet through which the polluted water is taken into a lower portion of the inner layer portion along an inner wall thereof, an inner pipe whose top end is located close to a ceiling surface of the inner layer portion and whose bottom end penetrates a floor surface of the inner layer portion, an outer layer portion covering the inner layer portion and communicating with the inner layer portion through a large number of small holes formed in an upper portion of a

peripheral wall of the inner layer portion, and an outlet through which the polluted water having the flocks filtered out by the small holes is drained, as purified water, out of the outer layer portion.

119. A polluted water purifier as claimed in claim 108, wherein the separator has a rotatable cylindrical filter, which collects the flocks from the polluted water flowing into the filter by centrifugal force and which then discharges the polluted water cleared of the flocks through a peripheral surface of the filter.

120. A polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant, comprising:

a pH value controller for lowering a pH value of the polluted water by adding an acid to the polluted water.

121. A polluted water purifier as claimed in claim 120, wherein the pollutant is an anionic surfactant and is present in the polluted water in a concentration of 400 ppm or lower.

122. A polluted water purifier as claimed in claim 121,
wherein the flocculant is a cationic inorganic flocculant.

123. A polluted water purifier as claimed in claim 120,
wherein the polluted water flowing out of the pH controller
has a pH value of 3 to 6.

124. A washing machine incorporating a purifier for
collecting a pollutant present in
polluted water by flocculating the pollutant with a flocculant,
comprising:

an aspirator for sucking in the flocculant and air to mix
the flocculant and the air with the polluted water and thereby
produce flocks holding bubbles; and

a separator for separating the flocks holding the bubbles
from the polluted water.

125. A washing machine incorporating a purifier as claimed
in claim 124,

wherein a motor for driving a washing tub or a pulsator
arranged inside a washing tub to rotate is provided, and the
separator has a cylindrical filter that is driven by the motor
to rotate, the filter collecting the flocks from the polluted

water flowing into the filter by centrifugal force and then discharging the polluted water cleared of the flocks through a peripheral surface of the filter.

126. A washing machine incorporating a purifier, comprising a water tub having a shape of a bottomed cylinder and a polluted water purifier that collects a pollutant present in washing wastewater by flocculating the pollutant to produce flocks and then separating the flocks by filtering the flocks out with a separator,

wherein the separator is fitted detachably to the water tub.

127. A washing machine incorporating a purifier as claimed in claim 126,
wherein the separator is fitted at an opening of the water tub.

128. A washing machine incorporating a purifier as claimed in claim 127,

wherein the separator is formed out of a same member as a tub cover for preventing washing water from splashing over a rim of the water tub.

129. A washing machine incorporating a purifier as claimed in claim 127,

wherein a recess is formed substantially at a center of the separator.

130. A washing machine incorporating a purifier as claimed in claim 126,

wherein a rotatable washing tub is provided inside the water tub, and a flow of air produced as the washing tub is rotated is kept in contact with the separator.

131. A washing machine incorporating a purifier as claimed in claim 130, wherein the separator is so formed as to protrude into the washing tub.

132. A washing machine incorporating a purifier as claimed in claim 126,

wherein an attachment detector for detecting attachment of the separator is provided so that operation of the washing machine is controlled according to a result of detection by the attachment detector.

133. A washing machine incorporating a purifier as claimed in claim 126, further comprising:

a flock detector for detecting an amount of the flocks collected in the separator; and

alerting means for giving an alert according to a result of detection by the flock detector.

134. A washing machine incorporating a purifier, comprising a water tub having a shape of a bottomed cylinder and a polluted water purifier that collects a pollutant present in washing wastewater by flocculating the pollutant to produce flocks and then separating the flocks by filtering the flocks out with a separator,

wherein the separator is fitted detachably so as to cover the water tub from above an opening thereof.

135. A washing machine incorporating a purifier as claimed in claim 134,

wherein a door is provided above the opening of the water tub, and the separator can be fitted to the door.

136. A washing machine incorporating a purifier comprising a polluted water purifier for purifying polluted water drained

from a washing tub by removing a pollutant present in the polluted water,

wherein, halfway through a washing process, washing water is circulated from the washing tub through the polluted water purifier back to the washing tub.

137. A washing machine incorporating a purifier as claimed in claim 136,

wherein an outertub is provided so as to enclose the washing tub, and the washing water flows from inside the washing tub to a space between the washing tub and the outer tub so as to be purified by the polluted water purifier, with the washing water prevented from flowing from the space between the washing tub and the outer tub back into the washing tub.

138. A washing machine incorporating a purifier as claimed in claim 137,

wherein the washing tub has increasing internal diameters toward an open end thereof.

139. A washing machine incorporating a purifier as claimed in claim 138,

wherein an amount of washing water discharged from the washing tub is varied by controlling rotation of the washing tub.

140. A washing machine incorporating a purifier as claimed in claim 139 wherein, while the washing water is circulated, the washing tub repeats a cycle of forward rotation, sudden stop, reverse rotation, and sudden stop.

141. A washing machine incorporating a purifier as claimed in claim 136 wherein the washing water that has flowed into the space between the washing tub and the outer tub is agitated by the washing tub as the washing tub is rotated.

142. A washing machine incorporating a purifier as claimed in claim 136, wherein the washing water that returns to the washing tub is poured substantially onto a central portion of the washing tub.

143. A washing machine incorporating a purifier as claimed in claim 136, wherein, after the washing water stops being circulated, final rinsing is performed with tap water.

144. A washing machine incorporating a purifier as claimed in claim 136, wherein the polluted water purifier flocculates the pollutant with a flocculant to produce flocks and then collects the flocks.

145. A washing machine incorporating a purifier and provided with a washing process for removing dirt on laundry with washing water containing a detergent and a first rinsing process for removing the detergent from the laundry, comprising:

a reservoir section for storing the drained washing water;
and

a polluted water purifier for purifying the washing water by collecting a pollutant present in the washing water stored in the reservoir section by flocculating the pollutant,

wherein the washing water used in the washing process and rinsing water used in the first rinsing process is stored together in the reservoir section and is purified simultaneously by the polluted water purifier.

146. A washing machine incorporating a purifier as claimed in claim 145, wherein the polluted water purifier first flocculates the pollutant with an inorganic flocculant and then

flocculates again the flocculated pollutant by adding a polymer flocculant thereto.

147. A washing machine incorporating a purifier as claimed in claim 145,

wherein a second rinsing process for performing rinsing with purified water obtained from the polluted water purifier is further provided.

148. A washing machine incorporating a purifier as claimed in claim 147, wherein a third rinsing process for performing, after the second rinsing process, rinsing with tap water is further provided.

149. A washing machine incorporating a purifier as claimed in claim 145, further comprising:

a washing tub that is rotatably supported and in which the laundry is put; and

an outer tub enclosing the washing tub,

wherein a space between the washing tub and the outer tub constitutes the reservoir section.

150. A washing machine incorporating a purifier and provided with a washing process for removing dirt on laundry with washing water containing a detergent and a first rinsing process for removing the detergent from the laundry, comprising:

a reservoir section for storing the drained washing water; and

a polluted water purifier for purifying the washing water by collecting a pollutant present in the washing water stored in the reservoir section by flocculating the pollutant,

wherein the washing water used in the washing process is purified by the polluted water purifier and is then used in the first rinsing process, and then rinsing water used in the first rinsing process is purified by the polluted water purifier.

151. A washing machine incorporating a purifier as claimed in claim 150,

wherein the rinsing water used in the first rinsing process and the washing water used in the washing process and then purified is stored together in the reservoir section and is purified simultaneously by the polluted water purifier.

152. A washing machine incorporating a purifier, comprising a polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant,

wherein the polluted water purifier comprises:

a mixer for mixing the polluted water with the flocculant and air;

an agitator for agitating the polluted water, containing the flocculant and the air, that flows into a cylindrical agitation chamber along an inner surface thereof by making the polluted water into a spiraling stream so that flocks formed by the flocculant hold bubbles; and

a separator, connected to the agitator, for temporarily storing the polluted water and for separating the flocks holding the bubbles.

153. A washing machine incorporating a purifier as claimed in claim 152,

wherein the mixer has an aspirator for sucking in the flocculant and the air under a reduced pressure.

154. A washing machine incorporating a purifier as claimed in claim 152,

wherein the agitation chamber is arranged upright and has a cylindrical mixing cylinder provided inside, and the polluted water, containing the flocculant and the air, first flows up as the spiraling stream along the inner surface of the agitation chamber and then flows down inside the mixing cylinder.

155. A washing machine incorporating a purifier as claimed in claim 154,

wherein the mixing cylinder has a spiral fin composed of a plurality of serially coupled substantially rectangular plate-shaped members each having opposite sides thereof twisted at a predetermined angle.

156. A washing machine incorporating a purifier as claimed in claim 154,

wherein the separator is formed integrally with and fitted detachably to the agitation chamber.

157. A washing machine incorporating a purifier as claimed in claim 152,

wherein the separator has a reservoir section for temporarily storing the polluted water and discharging the polluted water from a topmost section thereof and a filter

section for filtering out the flocks contained in the polluted water that has flowed out of the reservoir section.

158. A washing machine incorporating a purifier as claimed in claim 157, wherein the reservoir section is arranged inside the filter section.

159. A washing machine incorporating a purifier as claimed in claim 157, wherein the filter section collects the flocks with a collecting member composed of a washing net.

160. A washing machine incorporating a purifier as claimed in claim 152,

wherein a member arranged in a path of the polluted water has an inner wall thereof treated with non-cohesion treatment.

161. A washing machine incorporating a purifier, comprising a polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant,

wherein the polluted water purifier comprises:

a polluted water tank for storing the polluted water;

a first mixer for mixing the polluted water with a primary flocculant to produce primary flocks,

a second mixer for mixing the polluted water containing the primary flocks with a secondary flocculant and air to produce secondary flocks;

an agitator for agitating the polluted water containing the flocculant and the air so as to make the secondary flocks grow larger, and

a separator for separating the secondary flocks thus grown, wherein the polluted water tank, the first mixer, the second mixer, the agitator, and the separator are coupled in this order to form a circulation path that leads back to the polluted water tank.

162. A washing machine incorporating a purifier as claimed in claim 161,

wherein the first mixer has an aspirator for sucking in the flocculant, a first adder for adding the flocculant in a predetermined amount, and a first agitating chamber, cylindrical in shape, for agitating the polluted water containing the flocculant by making the polluted water into a spiraling stream.

163. A washing machine incorporating a purifier as claimed in claim 162,

wherein the first adder controls the amount in which the flocculant is added according to concentration, turbidity, or a pH value of the polluted water.

164. A washing machine incorporating a purifier as claimed in claim 161,

wherein the second mixer has an aspirator for sucking in the flocculant to mix the flocculant with the polluted water containing the flocks, a second adder for adding the flocculant in a predetermined amount, and a sucker for sucking in the air.

165. A washing machine incorporating a purifier as claimed in claim 164,

wherein the second adder controls the amount in which the flocculant is added according to concentration, turbidity, or a pH value of the polluted water.

166. A washing machine incorporating a purifier as claimed in claim 161,

wherein the agitator is provided with a second agitation chamber cylindrical in shape and arranged upright and a mixing cylinder cylindrical in shape and arranged inside the second agitation chamber, and the polluted water, containing the

flocculant and the air, first flows up as a spiraling stream along an inner surface of the second agitation chamber and then flows down inside the mixing cylinder.

167. A washing machine incorporating a purifier as claimed in claim 166,

wherein the mixing cylinder has a spiral fin composed of a plurality of serially coupled substantially rectangular plate-shaped members each having opposite sides thereof twisted at a predetermined angle.

168. A washing machine incorporating a purifier as claimed in claim 167,

wherein the separator has a reservoir section for storing the polluted water and a bag-shaped net, arranged inside the reservoir section, for collecting the secondary flocks as the secondary flocks float on the polluted water.

169. A washing machine incorporating a purifier, comprising a polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant,

wherein the polluted water purifier comprises:

a pH value controller for lowering a pH value of the polluted water by adding an acid to the polluted water.

170. A washing machine incorporating a purifier as claimed in claim 169, wherein the pollutant is an anionic surfactant and is present in the polluted water in a concentration of 400 ppm or lower.

171. A washing machine incorporating a purifier as claimed in claim 170, wherein the flocculant is a cationic inorganic flocculant.

172. A washing machine incorporating a purifier as claimed in claim 169, wherein the polluted water flowing out of the pH controller has a pH value of 3 to 6.

173. A method of purifying polluted water by collecting a pollutant present in the polluted water by flocculating the pollutant with a flocculant, comprising a step of lowering a pH value of polluted water by adding an acid to the polluted water.

REMARKS

The specification has been amended to provide a cross-reference to the previously filed International Application.

Claims 87-173 are pending in the present application. Claims 1-86 have been cancelled and claims 87-173 have been added.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly solicited.

Attached hereto is a marked-up version of the changes made to the application by this Amendment.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 
Charles Gorenstein

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2936-0146P
Attachments

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(Rev. 12/19/01)

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The specification has been amended to provide a cross-reference to the previously filed International Application.

IN THE SPECIFICATION:

Page 4, please delete the third paragraph beginning on line 18 and replace with the following:

--To achieve the above objects, according to the present invention, a wastewater treatment agent [is produced by mixing a first flocculant that is a high-molecular-weight substance and a second flocculant that is a low-molecular-weight substance, and acts by flocculating the surfactant components present in wastewater] flocculates a surfactant component present in wastewater with a primary flocculant composed of a high-molecular-weight inorganic flocculant or a mixture of a high-molecular-weight inorganic flocculant and a low-molecular-weight inorganic flocculant and makes the resulting flocks grow larger with a secondary flocculant composed of a high-molecular-weight organic flocculant.--

Page 5, please delete the 1st full paragraph beginning on line 6 and replace with the following new paragraph:

According to the present invention, a polluted water purifier for collecting a pollutant present in polluted water by flocculating the pollutant with a flocculant, or a washing machine incorporating

such a purifier, is provided with: a polluted water tank for storing the polluted water, a first mixer for mixing the polluted water with [the] a primary flocculant to produce primary flocks; a second mixer for mixing the polluted water containing the primary flocks with [the] a secondary flocculant and air to produce secondary flocks; an agitator for agitating the polluted water containing the flocculant and the air so as to make [the primary flocks hold bubbles and thereby produce secondary flocks] the secondary flocks grow larger; and a separator for separating the secondary flocks thus grown. [Here, the polluted water tank, the first mixer, the second mixer, the agitator, separator are coupled in this order to form a circulation path that leads back to the polluted water tank.]

IN THE CLAIMS:

Claims 1-86 have been canceled.

Claims 87-173 have been added.